Climate change, biodiversity and agriculture

By Lorraine Mc Gibbon and Steve du Toit

CLIMATE CHANGE – BIODIVERSITY AND AGRICULTURE

Regarded as another 'greeny issue' a couple of decades ago, climate change as a topic, is now mainstream. With the information readily available, why are we not doing more about it? Most of us working for environmental organizations continually grapple with this challenge.

Reasons for individuals not taking more action include ignorance, lack of personal responsibility and the fact that there are so many other pressing issues, like poverty and unemployment, which means that something threatening on the horizon remains in the future, whereas a place to stay today, food on the table and holding onto one's job are problems we face on a daily basis.

Biodiversity can be described as the variety of life in the World. And what a variety! Nearly 2 million species have been identified and more than 10 million are estimated to exist on our blue planet. This essay considers South Africa's rich but fragile natural heritage, the impacts of climate change, particularly on agriculture, and suggests some solutions.

There is a plant in the Klein Karoo called *Solanum tomentosum*; the Afrikaans name is 'gifappeltjie', or poison apple. In the genus *Solanum,* "… the pollen is released through a small pore in the front of the anthers and only when the insect pollinators 'buzz' at a specific frequency (generally known as 'buzz' pollination)" (Vlok & Vlok, 2010).

Read the previous sentence again, slowly. It carries four messages; consider:

- The evolutionary processes behind such a relationship;
- The inquisitive mind that first observed it;
- The consequences of the demise of *Solanum tomentosum*; and lastly,
- The consequences of the demise of the potato, tomato, or eggplant, all of which are globally important food crops belonging to the genus *Solanum*.

So what is the link between the Klein Karoo 'gifappeltjie', biodiversity and climate change… and humans?

About 7 000 plant species have been cultivated for food since agriculture began about 12 000 years ago. Today, however, only about 15 plant species and eight animal species supply 90% of our food (visit *http://www.cbd.int/* for an excellent booklet called *Biodiversity and Climate Change, 2007*). Modern crops contain traits from wild relatives which improve tolerance to pests, disease and difficult growing conditions. Wild relatives of food crops are considered an insurance policy for the future, as they can be used to breed new varieties that can cope with the changing conditions.

Unfortunately, many wild races of staple food crops are endangered. For example, one quarter of all wild potato species are predicted to die out within 50 years, which could make it difficult for future plant breeders to ensure that commercial varieties can cope with a changing climate.The conservation of the components of agricultural ecosystems that provide goods and services, such as natural pest control, pollination, and seed dispersal, is vital. Indeed, 35% of the world's crop production is dependent on pollinators such as bees, birds and bats (*http://www.cbd.int/*).

South Africa's opulent botanical heritage comprises of seven biomes (Succulent and Nama Karoo, Fynbos, Forest, Thicket, Savanna and Grassland). Containing about 10% of the world's flowering species, South Africa is the only country in the world with an entire plant kingdom within its borders: the Cape Floristic Kingdom, which contains 8 600 species, 68% of them endemic (visit *http://www.southafrica.info* for easy to read information about South Africa).

Within this opulence, humans continue to increase our footprint. The term 'sustainable development' appears to have been used rather loosely over the years and one wonders whether the two words can actually be used together. Development has so often linked with a high carbon footprint. Add to this, population growth which isn't only limited to more people using more natural resources in their home terrain. People, universally, strive for the material products and the high-user lifestyles. Yet local conditions hardly lend themselves to the way of life to which we all aspire.

The Proposed Gouritz Cluster Biosphere Reserve

Deserts are projected to become hotter and drier. Higher temperatures could threaten organisms that are already near their heat-tolerance limits. For example, climate change is likely to have serious impacts on the Succulent Karoo, the world's richest arid hotspot (a 'hotspot' is an area of high endemism under huge threat of biodiversity loss). South Africa has three globally important hotspots. The proposed Gouritz Cluster Biosphere Reserve straddles three distinct and world-renowned bioregions: the Fynbos, Maputoland -Tongoland -Albany and the Succulent Karoo hotspots. All three are of major global significance, and are among the world's top 25 global biodiversity hotspots (track the progress of this reserve on *www.gouritz.com*).

Farming and tourism play significant roles in the economic arena of the Gouritz Cluster Biosphere. Tourism focused on the scenery and farming on the climate historically suited to ostrich farming, and crops irrigated from the rivers and dams. The farm lands have already displaced the natural vegetation and continue to do so. However, the agricultural sector provides work for many people, as well as housing and other support. And then there is the issue of food security which is becoming increasingly important. Both the tourism and the agriculture industries are heavily dependent on climate and weather. Agriculture forms the backbone of economic activities in the Klein Karoo, an area already stressed by lack of water, climate models forecast drier and hotter conditions. Research studies have recently examined Garden Route farmers' perceptions of climate change and considered their current farming practices with regard to changes in climatic conditions (du Toit et al, 2010). It was found that current farming methods would, in some instances, not be sustainable in a changing climate.

Thanks to support from the Ostrich Business Chamber and CapeNature, farmers in the Klein Karoo are moving their ostriches into smaller camps, thereby reducing the trampling effect which has done such damage to extensive areas and which has resulted in the loss of biodiversity in the veld. On a visit to one of the farmers involved in the Ostrich and Biodiversity Project, he spoke with passion and conviction about the benefits he is already deriving from the small camp farming practice. This farmer is enthusiastic about the recovery of veld after removal of the ostriches into the smaller camps. Unexpected benefits include having more control over the outbreak of disease, and improved vigilance for predators. By using feeding bins, this farmer is also saving money on his feed bill.

The greatest challenge is the wise and sustainable management

Biosphere Reserves: Landscape scale initiatives promoting the wise management of natural resources, while promoting sustainable employment

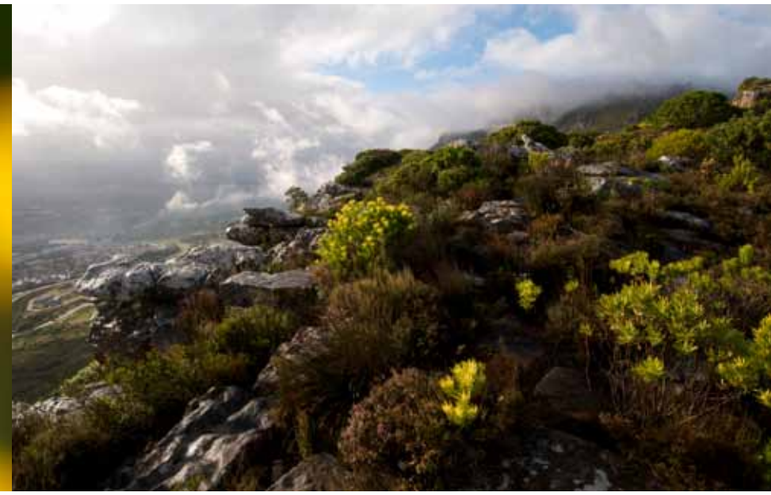
of water resources. For farmers to remain in the business in which their families have often been involved for generations, their farming methods need to change to adapt to the changing climatic conditions. The water issue can be addressed from two angles: better use of available water and how to harness rain which falls in greater quantities with longer dry periods in between.

There are several farming practices which can be changed to make better use of available water and many of these have already been put into practice. No-tillage and dry land farming protect the top layers of the soil, not just serving to keep soil from being eroded by heavy rains and wind, but also preventing carbon loss. Leaving the crop residue on the land contributes to organic waste feeding the soil for the next crop, reducing the need for synthetic fertilizers and compost. Farmers need to be alert to probable shifts in the length of the growing season of crops, as well as times for planting. Closely linked to this will be the consideration of crops which may be better suited to the changing climatic conditions. The southern Cape was not regarded as a grape farming region, yet one now sees vineyards in the Little Karoo, Mossel Bay and Plettenberg Bay.
Economic pressure on stock farmers and game ranchers has led to over-stocking resulting in over-grazing. Erosion, by wind and water, is affecting areas of veld, exacerbating the situation. The past few years have been marked by lengthy periods of no rain, interspersed with heavy rainfall, resulting in flood damage. With further erosion and the loss of the water through run-off, farmers request more dams for storage of such water. However, the building of dams comes with several environmental issues, amongst them disturbance of the natural water course flow and the effects downstream. There are several cases of local dam walls bursting during floods with enormous damage and loss of livestock and game downstream. It is therefore not surprising that the Western Cape State of Environment Report (2005) stated that the majority of rivers in the Western Cape are in a critical condition; more than 90% were already in an endangered or critically endangered state.

In our water scarce country, with the large agriculture sector and overloaded waste water treatment plants, there are valuable opportunities for the creation of artificial wetlands. A healthy wetland functions like a huge sponge, absorbing floodwater and slowly releasing it over a period of time. This enables water to filter through the soil and feed into the aquifers. The purification effect of wetlands supports biodiversity.

Research and technology is improving ways to reduce the use of fresh water and minimize the loss of water through evaporation. Grey water from households can be fed through 'wetlands' and used in food production. We need to look at new technology whilst also considering some of the traditional ways of using our natural resources. The demand for clean water is increasing as our population grows. Demand is outstripping the available water. Faced with the climatic changes predicted, each of us needs to take responsibility for how we use our natural resources. Education is playing an increasingly large role.

For many of us, learning comes the hard way. The lengthy period



Flowers and pollinators - a critical balance

of dry weather in the southern Cape was a wake-up call to most residents, and resulted in booming sales for water tanks. These dry spells, followed by heavy rains seem to be indications of the new regime. The research project into climate change and agriculture emphasized the need for farmers to be supported at an institutional level to enable them to effect changes to their farming practices. Research was highlighted as was the value of working together.

Economists say "invest in the limiting factor". The factor in short supply is now natural capital, not manmade capital, as it used to be. For example, populations of fish, not fishing boats, limit fish catch. It is therefore logical to invest in the limiting resource from a developing perspective: WATER!

"An efficient way to invest in water security is to protect it at its source through prudent land management. In this way, investing in land management becomes a water augmentation, quality and regulation intervention" (Mander *et al*., 2007).

Payment for ecosystem services is the practice of offering incentives to landowners or farmers in exchange for managing their land to provide some sort of ecological service (http://en.wikipedia.org/wiki/Payment_for_ecosystem_services); the authors are currently investigating the suitability of a payment for watershed services project for the Knysna catchment.

These thoughts highlight some of the changes necessary to adapt to a changing climate. By conserving our biodiversity, we strive to maintain long-term ecosystem productivity and to ensure the wise management of our natural resources. This brings us back to the 'gifappeltjie' in the Klein Karoo. We can only wonder at the millions of years it took nature to perfect this relationship between plant, pollinator and where it fits into the greater ecosystem. There is so much we don't yet know. And yes, maybe that 'gifappeltjie' will have the traits needed for the development of a food crop which is well adapted to our changed climate. ✖

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Further reading

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